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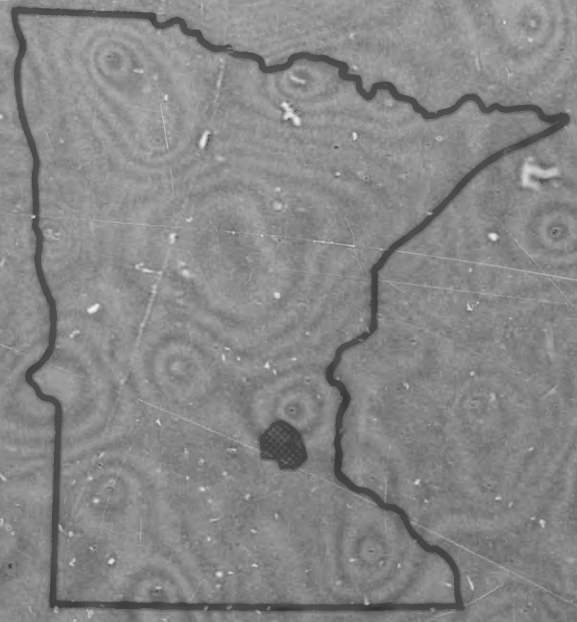
FLOOD INSURANCE STUDY

ORIGINAL

CITY OF GOLDEN VALLEY, MINNESOTA

HENNEPIN COUNTY



REVISED:
AUGUST 19, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 270162

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Individual components of this Flood Insurance Study (i.e., text, tables, profiles, and maps) are subject to revision as additional data become available. Because revised components may be issued separately, study users should consult the community map repository for those components that are currently effective.

In cases where this Flood Insurance Study and any components thereof warrant revision, a Revisions Description section may be incorporated into this text. When applicable, study users should refer to the Revisions Description to obtain pertinent data and information concerning revisions.

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

CITY OF GOLDEN VALLEY,
HENNEPIN COUNTY, MINNESOTA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Golden Valley, Hennepin County, Minnesota, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Golden Valley to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Edwards and Kelcey, Inc., for the Federal Insurance Administration, under Contract No. H-3983. This study was completed in June 1979.

1.3 Coordination

Streams to be studied by detailed or approximate methods were determined at an initial coordination and time and cost meeting on March 9, 1976. Flood elevations, flood boundaries, and floodway delineations were coordinated with the City Manager; the City Engineer; the Bassett Creek Watershed District; the Minnesota Department of Transportation; the U.S. Army Corps of Engineers (COE); the U.S. Geological Survey (USGS); the U.S. Department of Agriculture, Soil Conservation Service (SCS); and the Bassett Creek Flood Control Commission. Base maps were obtained from the City Manager, the City Engineer, and the FIA.

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On January 10, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by the FIA, the Study Contractor, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the City of Golden Valley. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction through 1984.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and the City of Golden Valley.

The flooding sources studied by detailed methods are listed below:

a. Bassett Creek, from the western corporate limit (Mendelsson Avenue) to Golden Valley Road; and

b. Bassett Creek-Sweeney Lake Branch, from its headwaters at Glenwood Avenue to Sweeney Lake.

Portions of Bassett Creek and Bassett Creek-Sweeney Lake Branch were studied by approximate methods.

2.2 Community Description

The east-central Minnesota community of Golden Valley is located in the western portion of the Twin Cities metropolitan area as a first-tier suburb of Minneapolis. Golden Valley is bordered on the south by the community of St. Louis Park; on the west by the Cities of St. Louis Park and Plymouth; on the north by the Cities of New Hope, Crystal, and Robbinsdale; and on the east by the City of Minneapolis. The population according to the 1970 census was 24,226 (Reference 1). Spurred by outward migration from the central city (Minneapolis), the majority of growth occurred in the years 1956 to 1970. The population density of 3.6 persons per acre is about average for the Bassett Creek watershed. The recent decrease in population is due to a shift toward smaller family sizes and a resultant decrease in population densities.

The climate of the area is subhumid, characterized by large seasonal variations in temperature, normally sufficient rainfall for crops, and

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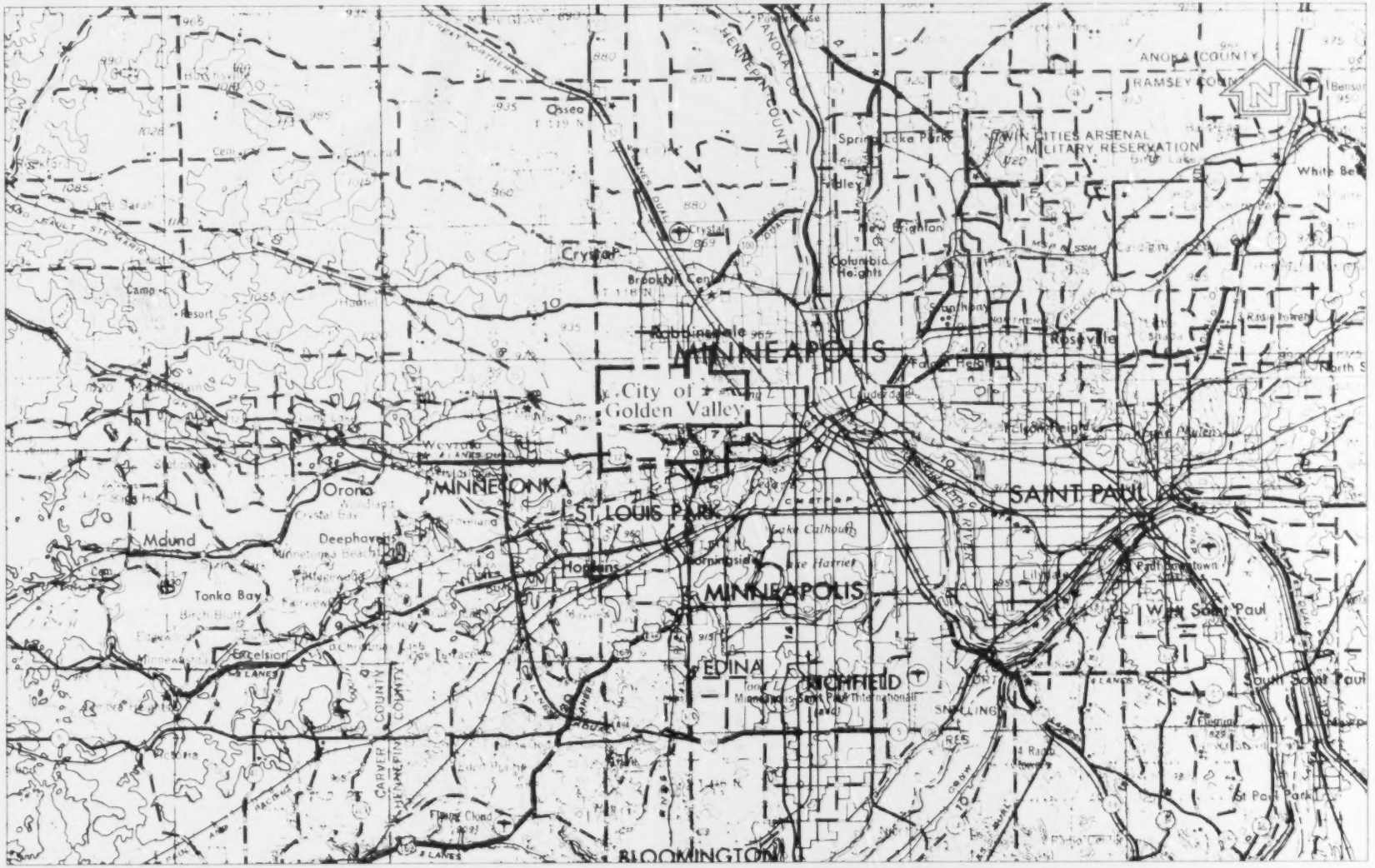

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

moderate snowfall. The summers are warm and moderately humid, with occasional short periods of hot, very humid weather. The winters are cold and moderately humid. The mean annual temperature is 44.1 degrees Fahrenheit (F.) with the variation in mean monthly temperatures varying between 12.2 degrees F. in January to 71.9 degrees F. in July. Temperature extremes range from a high of 108 degrees F. on July 14, 1936, to a low of -41 degrees F. on January 21, 1888.

Intense summer thunderstorms are common and are occasionally accompanied by tornado activity. A record summer storm recorded at the Minneapolis-St. Paul International Airport occurred during August 1977 when 7.25 inches of rain fell in a 5-hour period and was accompanied by high winds. Winter storms with high winds causing severe blizzard conditions occur occasionally. The worst winter storm of record occurred January 10-11, 1975, when 7 inches of snow fell in a 24-hour period and was accompanied by winds of up to 60 mph. The record 24-hour snowfall, as recorded at the Minneapolis-St. Paul International Airport, was 16.2 inches on November 12, 1940. Annual precipitation averages 25.9 inches and has ranged from a low of 11.5 inches in 1910 to a high of 40.1 inches in 1911. The mean monthly precipitation varies from about 4.0 inches in June to about 0.7 inch in January; approximately 70 percent of the precipitation occurs during the growing season. Snowfall averages about 44 inches annually and represents approximately 17 percent of the total precipitation. Snowfall extremes range from 88.9 inches during the 1950-51 season to 14.2 inches in 1930-31 (Reference 2).

The topographic relief of the Bassett Creek watershed, and hence Golden Valley, is about 210 feet. The western watershed boundary is about elevation 1,000. From this point east, the northern and southern boundaries drop to approximately elevation 800 where the creek enters the Mississippi River. Extensive urbanization has greatly altered the natural topography of the watershed, although drainage patterns generally follow natural watershed boundaries.

The rolling topography and soil types found in the city area are those typically found in glacial moraines. The most recently deposited glacial till in the area was deposited with the retreat of the Grantsburg Sublobe of the Des Moines Lobe during the Wisconsin glacial period. The glacial drift left behind is a heterogeneous mixture of sand, silt, and clay; the thickness is somewhat greater than 100 feet and varies throughout the watershed. The watersheds are underlain by five major bedrock aquifers: the St. Peter Sandstone, Prairie-du-Chien Dolomite, Jordan Sandstone, Franconia-Galesville Sandstones, and the Mt. Simon-Hinckley Sandstones. In addition, there are numerous aquifers in the glacial drift. Some groundwater from the glacial drift and the St. Peter aquifers discharge into Bassett Creeks. The remaining aquifers discharge into the Minnesota and the Mississippi Rivers, the movement of which is complicated by intersecting rift valleys. The ground water in all the major aquifers and glacial drift is of the calcium bicarbonate type.

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Natural vegetation in Golden Valley has been greatly altered by agricultural development and increasing urbanization. Remaining vegetation is typical of the Eastern Deciduous Forest-Temperate Grassland interface. With farming rapidly diminishing, urbanization is occurring in former agricultural areas and pressure to develop existing natural areas is occurring. In addition to the forested areas, numerous wetlands were once present in the central and eastern portions of the city, but the majority have been drained or filled for development.

Bassett Creek begins as outflow from Medicine Lake and flows easterly through the communities of Plymouth, Golden Valley, and Minneapolis until its confuence with the Mississippi River some 12 miles downstream. It collects water from each of three subwatersheds and acts as the major drainage way in the City of Golden Valley. The primary causes of flooding along the stream are inadequate channel and structure hydraulics.

The headwaters of Bassett Creek-Sweeney Lake Branch are located in a low marshy area near Good Shepherd School located just off Glenwood Avenue. The stream flows east and north, flowing through Sweeney Lake before its confluence with the main stem just downstream of Golden Valley Road. Throughout this reach, the stream flows through several low marshy areas where the channel is ill-defined; in other areas, the channel is very shallow with minimal cross sections.

Development has been primarily residential in nature. As urbanization proceeded westward from Minneapolis, commercial and industrial areas have developed along major highways and transportation facilities. While commercial and industrial development is distributed throughout the city, concentrations of these activities occur near the interchanges of U.S. Highway 12 and State Highway 55 with Mendelsson Avenue, along U.S. Highway 12 west of State Highway 100, in the vicinity of the State Highway 55 - State Highway 100 interchange, and between the Minneapolis, Northfield, and Southern Railway and Douglas Avenue.

Some of the area adjacent to flood plains is either undeveloped or in park or open space usage. There are homes located immediately adjacent to Bassett Creek (especially in the area downstream of the Lilac Drive crossing) that have experienced past flooding. Residential development is generally parallel to the main stem and damages are limited due to valley configurations.

2.3 Principal Flood Problems

Flooding in Golden Valley has occurred both from summer rainstorms and spring snowmelt runoff. The large number of isolated flooding events which have occurred have been recorded in little or no detail. Residents have indicated that while most of the isolated instances of damaging flooding have resulted from summer thunderstorms, flooding has not been strictly

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limited to that cause. Flooding following high intensity rainstorms has occurred above locations in the creek where the discharge capacity has been limited by a culvert or an inadequate channel.

The potential for flooding along Bassett Creek is quite great due to the urbanized nature of the watershed, the many creek crossings by roads or other constrictions, and the lack of storage sites along the channel. Serious flooding has not been extensive since the watershed has not recently experienced a high intensity storm with a generalized distribution over the entire watershed. The most recent case of severe flooding occurred in July 1978.

Major floods have occurred in 1903, 1942, 1974, 1975, and 1978. On September 5, 1903, 5 inches of rain in 10 hours caused extensive flooding at the conduit entrance in north Minneapolis. Flooding occurred at the conduit entrance in north Minneapolis in June 1942. This event has been estimated as having a 50-year recurrence interval (Reference 3). Lack of development minimized damages in Golden Valley.

On June 6, 1974, 5.5 inches of rain in a 6-hour period caused sanitary sewer backup in Golden Valley due to excessive infiltration into wastewater collection facilities. Also, many street intersections and other low-lying areas were inundated. This was estimated as a 25-year event.

On April 27, 1975, 2.5 inches of rain in a 24-hour period aggravated saturated antecedent conditions causing a flood having an estimated 25-year recurrence interval. Excessive infiltration into wastewater collection facilities caused sanitary sewer backup. Also, many street intersections were inundated. The low area between Regent Avenue and Lilac Drive experienced flood damages.

Flooding from a summer rainstorm which dropped three to five inches of rain over the watershed in two hours on July 6, 1978, caused content and structural damage to homes located between Regent Avenue and Lilac Drive. This corresponds to a 100-year return frequency in this area. Flooding also resulted in the inundation of walkout basements adjacent to Bassett Creek, sanitary sewer backup, and intersection flooding.

2.4 Flood Protection Measures

There are no existing federal or state flood control projects located in the Bassett Creek watershed. The fixed spillway-like level control dam on Medicine Lake (located upstream of County Road 18 in Plymouth) restricts the outlet capacity of the lake and provides temporary storage of floodwaters. A lake level control structure on Sweeney Lake and the downstream crossings restrict the discharge capacity contributing to flow on the main

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stem and provides temporary storage of floodwaters. The primary purpose of these control structures is to maintain normal lake levels during non-flood periods.

Existing channel crossings of Bassett Creek restrict flood flows and provide substantial inundation storage which significantly reduces the major flood peaks. The locations of significant areas of existing inundation storage are the Brookview Golf Course, Bassett Creek Park, Rice Lake, and Theodore Wirth Park. Further flooding occurs in a natural ponding area downstream of Lilac Drive.

In March 1976, the St. Paul District COE completed a Feasibility Study for Flood Control on the main stem and tributaries of Bassett Creek (Reference 3). The study developed several structural and nonstructural improvements to the watershed that would result in protection against a flood having a 1.0 percent recurrence interval. At that time, a design option was found to be cost beneficial and was selected for future consideration. In the fall of 1978, Congress authorized $200,000 for final design studies. Presently, the final design and construction dates for the proposed plan is uncertain. Due to the inherent uncertainty of design and timing, none of the following features of the selected plan were included in the hydraulic and hydrologic analysis.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

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There are no continuous streamflow records available for the Bassett Creek watershed; however, the USGS has collected limited streamflow data at four partial-record stations in the watershed since 1952. There are two stations on the main stem of Bassett Creek: one located at the Golden Valley Road bridge in Golden Valley and the other located near Fruen Mill in Minneapolis. In addition, there is a station on Bassett Creek North Branch at the 34th Avenue North culvert in Crystal and on the Bassett Creek-Sweeney Lake Branch at the State Highway 55 culvert in Golden Valley. Generally, discharges have been measured several times per year at each station.

As previously discussed, the process of urbanization in the Bassett Creek watershed is well advanced in the areas tributary to Golden Valley. Urban development has drastically altered the natural drainage patterns and hydrologic characteristics of the watershed. Infiltration characteristics are reduced by the covering of permeable soils with impervious surfaces, the extent of modification depending on the type and density of urban land use. Small natural depressions are filled and graded smooth, reducing the natural depression storage in the watershed. Storm sewer and channel improvements provide hydraulically efficient means of removing storm runoff. These factors result in increased storm runoff volumes and higher peak runoff rates.

The major portion of the watershed tributary to the main stem in Golden Valley and Minneapolis is urbanized. The slope of this reach varies considerably from less than 3 feet per mile between Winnetka Avenue and the upstream corporate limits and in the Theodore Wirth Park area to more than 17 feet per mile between Hampshire Avenue and Pennsylvania Avenue. The average slope of this reach is approximately 9 feet per mile.

Bassett Creek-Sweeney Lake Branch drains portions of St. Louis Park and Golden Valley and joins the main stem in Wirth Park. Throughout most of this reach, the creek flows through a series of ponds and marshes and the channel is generally undefined. From the Minnesota Northern and Southern Railway (upstream of Glenwood Avenue) to the point where it flows into Sweeney Lake, a distance of 1.1 miles, the creek drops approximately 23 feet.

Sweeney Lake forms a large natural flood storage area due to a fairly restrictive outlet located just upstream of the confluence with the main stem. On Sweeney Lake Branch there are nine channel crossings in about a mile, all of which are restrictive to major flood flows. In addition, several upland storm drainage ponding areas provide substantial flood storage.

The hydrology for the Bassett Creek watershed within Golden Valley was prepared by the Flood Control Commission Engineers for the 1976 COE Feasibility Study (Reference 3) utilizing the HEC-1 Flood Hydrology Program (Reference 4). To determine the peak discharge at various points

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along the channel, the watershed was subdivided into 42 subbasins varying in size from 0.13 to 9.44 square miles. Generally, the outlet of each of the subbasins was at a restrictive channel crossing as previously discussed. For each subbasin, the percentages of impervious areas were determined both for existing development conditions and for expected ultimate development. Solid data were reviewed and the infiltration losses were determined for each subbasin for both existing and ultimate conditions. The average estimated loss, including depression storage and interception losses, ranged from 0.28 inches per hour to 0.48 inches per hour with existing urbanization and from 0.15 inches per hour with ultimate urbanization.

Point rainfall depths of various durations for the 10-, 50-, and 100-year rainfall were obtained from the National Weather Service Technical Report No. 40, "Rainfall Frequency Atlas of the United States", and were adjusted for areal distribution (Reference 5).

Due to the large amounts of temporary storage in the lakes, ponds, and behind restrictive channel crossings, the rainfall adopted is generally not critical. This storage capacity modulates the effect of varying hydrograph assumptions.

The lag time for each subbasin was estimated from the characteristics of the subbasin. The peak for the unit hydrograph was then determined based on the estimated subbasin lag. Again, the effects of both the natural storage in the watershed and the effects of the storage behind the many restrictive channel crossings will modulate the effects of varying assumptions in the determination of unit hydrograph characteristics. Synder coefficients were calculated from the estimated unit hydrograph peaks and subbasin lag. Runoff hydrographs for each subbasin were determined and routed through the watershed using HEC-1 (Reference 4). Discharge-storage relationships were determined for each storage area. The runoff hydrograph from upstream areas was routed through these storage areas using reservoir routing techniques. In some instances, storage-discharge relationships for major flood storage areas were revised to reflect changed conditions or newly acquired information. In these cases, the channel discharges determined in the Preliminary Feasibility Study were revised to reflect the revised storage discharge relationships (Reference 3). The downstream decreases in discharges are due to overbank storage from restricted hydraulic structures.

As described above, the 10-, 50-, and 100-year discharges were obtained from work prepared for the COE Feasibility Study (Reference 3). Due to changing conditions with the watershed tributary to Bassett Creek between Dresden Lane and Regent Avenue (Reference 6), the discharges for the reach were reduced by an average of seven percent from those discharges shown in the Feasibility Study. The 500-year recurrence interval discharge was determined by the Study Contractor by graphically extrapolating the 10-, 50-, and 100-year discharges on log-probability paper.

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Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross sections were originally prepared for the COE Feasibility Study and were obtained from the engineer for the Flood Control Commission (Reference 3). Cross sections were checked by the Study Contractor using 1976 aerial photography that was unavailable to the COE (Reference 7). Revisions to COE HEC-2 input data were made as necessary to reflect current channel conditions (Reference 8). Field cross sections for Bassett Creek-Sweeney Lake Branch were obtained via stadia techniques. These sections were used to ensure adequate flood plain delineations.

Mannings "n" values for Bassett Creek were estimated from field inspection, stream photographs and topographic maps (References 7 and 9). The "n" values were then calculated through analysis of high water marks from prior flood events. The range of "n" values range from 0.045 to 0.010 in the overbank areas and from 0.035 to 0.045 in the channel. Roughness values because of corrugated metal pipes are 0.025; values because of reinforced concrete pipes are 0.012.

Starting water-surface elevations for the hydraulic modeling were obtained from the elevations determined during routing of the backwater areas. The water-surface elevations in the temporary storage areas at the time of greatest inflow, as calculated using HEC-1 (Reference 4) were used for the starting water-surface elevations of each hydraulically modeled reach. Starting water-surface elevations for Bassett Creek-Sweeney Lake Branch were obtained from an analysis prepared from the COE 1976 Flood Control Feasibility Study (Reference 3). Water-surface elevations in the temporary storage areas at the time of greatest inflow, as calculated by HEC-1, were used for the starting water-surface elevations (Reference 4). Due to restrictive hydraulic structures, the entire stream reach was reservoir routed. Reservoir-routing for this reach was prepared utilizing discharge-storage-elevation relationships supplied by the Flood Control Commission Engineer and verified by the Study Contractor.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). The COE HEC-2 program (Reference 8) was used to calculate the water-surface profiles in the reaches between temporary storage areas. These temporary storage areas are generally caused by restrictive hydraulic structures and are located within Theodore Wirth Park upstream of Olson Memorial Highway in the reach from Dresden Lane to Bassett Creek Drive,

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TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA SQ MILES	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
BASSETT CREEK					
Golden Valley Road	25.2	700	823	865	965
Dresden Lane	24.1	707	821	865	965
Medicine Lake Road	19.4	736	801	825	880
Just downstream of the Minneapolis, Northfield, and Southern Railway	18.5	686	747	769	820
About 1,400 feet downstream of Pennsylvania Avenue	17.8	701	770	795	844
Just upstream of the Chicago and North Western railroad	17.6	684	752	776	824
BASSETT CREEK-SWEENEY LAKE BRANCH					
Chicago and North Western railroad	3.3	227	273	287	330
Minneapolis, Northfield, and Southern Railway	2.6	313	351	366	390
Lilac Drive	2.2	578	796	892	1,115
Minneapolis, Northfield, and Southern Railway	1.4	463	585	638	755

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between Regent Avenue and Lilac Drive, through the Golden Valley Golf Course, and between Winnetka Avenue and the city limits at Mendelsson Avenue. The HEC-2 standard step-backwater model used in the COE Feasibility Study (Reference 3) was originally prepared by, and obtained from, the engineer for the Bassett Creek Flood Control Commission. The coding was revised by Edwards and Kelcey staff to reflect hydraulic conditions as of July 1978 and to reflect valley conditions (including stationing) shown on two-foot contour topographic mapping prepared by the city in 1976 and utilized as workmapping in this Flood Insurance Study (Reference 10).

The approximate study of Bassett Creek and Bassett Creek-Sweeney Lake Branch was conducted using normal depth calculations.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using aerial photographs at a scale of 1:1200, with a contour interval of two feet (Reference 7). Approximate flood boundaries were determined using these same topographic maps.

Flood boundaries are indicated on the Flood Insurance Rate Map (Panels 0001-0004). On this map, the 100-year flood boundary corresponds to the boundary of the areas of special flood hazards (Zones A, A1, A2, A4, A6); and the 500-year flood boundary corresponds to the boundary of areas

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of moderate flood hazards (Zone B). Small areas within the flood boundaries may lie above the flood elevationsand, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. In Minnesota, however, flood plain encroachment is limited by Minnesota Regulations to that which would cause a 0.5-foot increase in flood heights above prefloodway conditions at any point (Reference 11).

Floodways were not computed for Bassett Creek and Bassett Creek-Sweeney Lake Branch for the following reasons:

a. Due to the nature of flooding in many areas (i.e. backwater from restrictive hydraulic structure) a traditional floodway analysis is considered inappropriate for many areas. Reservoir routings preclude development of a floodway through accepted methods.

b. The COE flood control project (Reference 3) will create certain upstream impoundment areas and increase the hydraulic capacity. The extent, location, and timing of these improvements is uncertain at this time. Delineation of a floodway may allow development within areas required for future flood control works.

c. The Bassett Creek Flood Control Commission is currently enforcing a management "envelope" controlling development within the watershed. This "envelope" is always either equal to the existing 100-year flood plain or more restrictive; the intent is to keep all future flood control options open insofar as is possible. The Flood Control Commission will continue to

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enforce this more restrictive condition until such time as the COE work has been completed. The engineers for the Flood Control Commission requested the FIA, through Edwards and Kelcey, to delineate the 100-year flood plain as the floodway; therefore, there is no flood fringe. Edwards and Kelcey prepared Special Problem Report No. 6, dated July 18, 1978, concerning this request. An affirmative verbal response to this Special Problem Report was received from the FIA on August 7, 1978.

d. On August 17, 1978, a meeting was held among representatives of the City of Golden Valley, the Minnesota Department of Natural Resources (DNR), the Bassett Creek Flood Control Commission, and Edwards and Kelcey, Inc. At that time the city requested that the floodway be identified as the 100-year flood plain; development would continue to be controlled by the Flood Control Commission and city zoning ordinances. (The present ordinance regulates via elevations rather than mapping delineations). On September 12, 1978, representatives of the Bassett Creek Flood Control Commission, the DNR, and Edwards and Kelcey met in the DNR offices to discuss the Golden Valley floodway. At that time, they determined that acceptance of political floodway limits equal to the 100-year flood plain delineation would best meet the needs of the City of Golden Valley. The DNR felt that the city's existing zoning ordinances provided adequate safeguards against future development within the 100-year flood plain.

In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.5 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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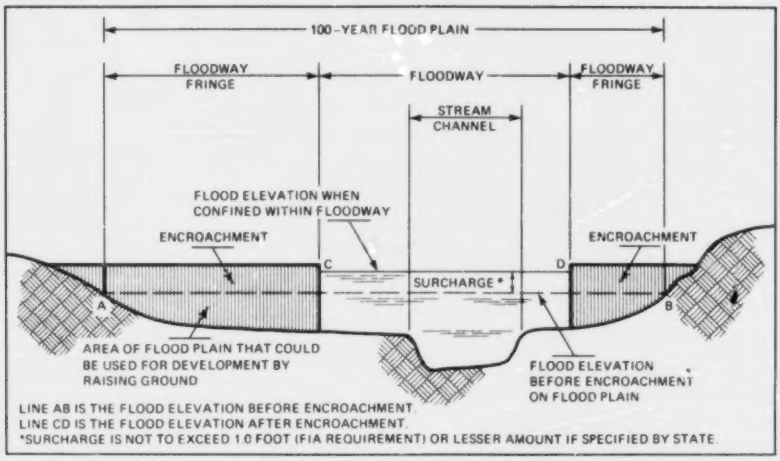
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the City of Golden Valley.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Golden Valley are shown on the Flood Profiles and are summarized in the Flood Insurance Zone Data Table (Table 2).

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5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the City of Golden Valley was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zones A1, A2, A4, A6:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 2, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
BASSETT CREEK							
REACH 1	0002	−1.2	N/A	0.6	010	A2	VARIES–SEE MAP
REACH 2	0001,0002,0003	−0.3	−0.1	0.2	005	A1	VARIES–SEE MAP
BASSETT CREEK–SWEENEY LAKE BRANCH							
REACH 1	0004	−1.9	−0.8	2.3	020	A4	VARIES–SEE MAP
REACH 2	0003,0004	−3.0	−1.0	1.7	030	A6	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD INSURANCE ZONE DATA

BASSETT CREEK - BASSETT CREEK-SWEENEY LAKE BRANCH

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Golden Valley is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

A preliminary report, Projected Study and Report on the Bassett Creek Watershed (Reference 12), detailing the stormwater drainage problems in the watershed and developing a plan to provide protection from a 10-year frequency storm was prepared by a consulting engineering firm in 1961. The report recommended storage sites and channel improvements throughout the watershed to provide that protection.

A Watershed Management Plan for Bassett Creek was prepared and adopted by the Bassett Creek Flood Control Commission in May 1972 (Reference 13). The plan delineated the 100-year frequency flood plain and established a "management envelope" or elevation below which future development would be restricted. The management of this "envelope" will preserve the various options available for flood control until a plan which meets the needs of the public can be implemented. The plan was based on ultimate watershed development and includes proposed hydrologic and hydraulic changes which do not, at this time, exist. Further, watershed changes have occurred which were not considered in the development of the profiles and flood plain delineations. Discharge figures are slightly higher in certain areas than those used in the Golden Valley Flood Insurance Study. Flood plain delineations are similar. As noted in the sections for hydrology and hydraulics, all work for this study was coordinated with the consultants for the Flood Control Commission.

The COE prepared a Feasibility Report for Flood Control, Bassett Creek Watershed in March 1976 (Reference 3). Changes to the watershed have occurred which were not considered in the development of the 100-year profiles. Discharge figures have been revised; the COE has been notified of these differences and concurs with the elevations presented herein.

This report is compatible with the Flood Insurance Studies for the City of Plymouth, the City of St. Louis Park, and City of Crystal, the City of Robbinsdale, the City of New Hope, and the City of Minneapolis (References 14, 15, 16, 17, 18, and 19).

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 20). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

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This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, One North Dearborn Street, Chicago, Illinois 60602.

8.0 REFERENCES AND BIBLIOGRAPHY

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9.0 REVISIONS DESCRIPTION (Revised August 19, 1986)

9.1 Purpose

The purpose of this Flood Insurance Study Revisions Description is to incorporate revised data into this currently effective Flood Insurance Study for the City of Golden Valley, Hennepin County, Minnesota. This Revisions Description is intended to provide updated information that aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

9.2 Acknowledgments

The hydrologic and hydraulic analyses for this Revisions Description were obtained from the Minnesota Department of Natural Resources. The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

9.3 Scope

The Bassett Creek Flood Control Commission has implemented several flood control measures and stream improvements on Bassett Creek from Golden Valley Road to State Highway 100. The improvements to Bassett Creek include the removal of an existing channel crossing, improvement of a channel crossing, and addition of a flood control structure. The hydrologic and hydraulic analyses for this stream were revised to include these improvements.

9.4 Hydrologic and Hydraulic Analyses

The hydrologic analysis of Bassett Creek was updated to include the flood control and stream improvements. Peak discharges were determined using the HEC-1 flood hydrograph program (Reference 1). These discharges are summarized in Table 3.

TABLE 3 - REVISED SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	100-YEAR
BASSETT CREEK			
at Golden Valley Road	25.2	430	570
about 11,000 feet downstream of Lilac Drive	19.4	310	490

The HEC-2 model used in the U.S. Army Corps of Engineers report entitled, "Report on Bassett Creek Watershed, Bassett Creek Water-Surface Profiles" (Reference 2) was updated to include the new discharges and stream improvements. The updated model was used to calculate the 10- and 100-year flood elevations shown on the flood profile. The 500-year flood profile was approximated using the previously calculated elevations and the new 100-year flood profile.

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9.5 Other Studies

The Flood Insurance Study for the City of Crystal (Reference 3) is currently being revised based on information from this study. Upon completion, both revisions will be in agreement.

9.6 Location of Data

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.7 References and Bibliography

1. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Computer Program 823-X6-L2610, Davis, California, January 1973.

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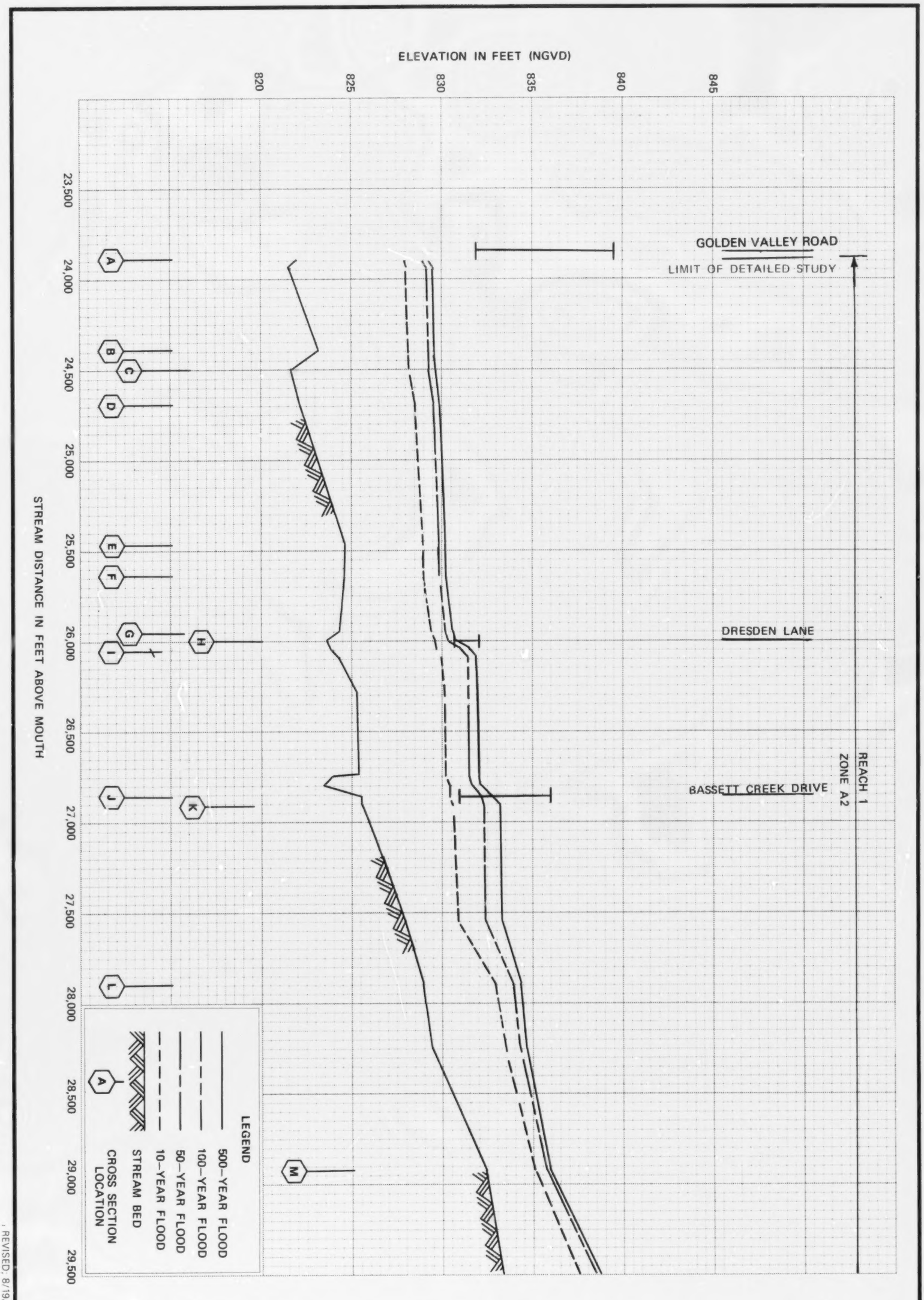

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

01P

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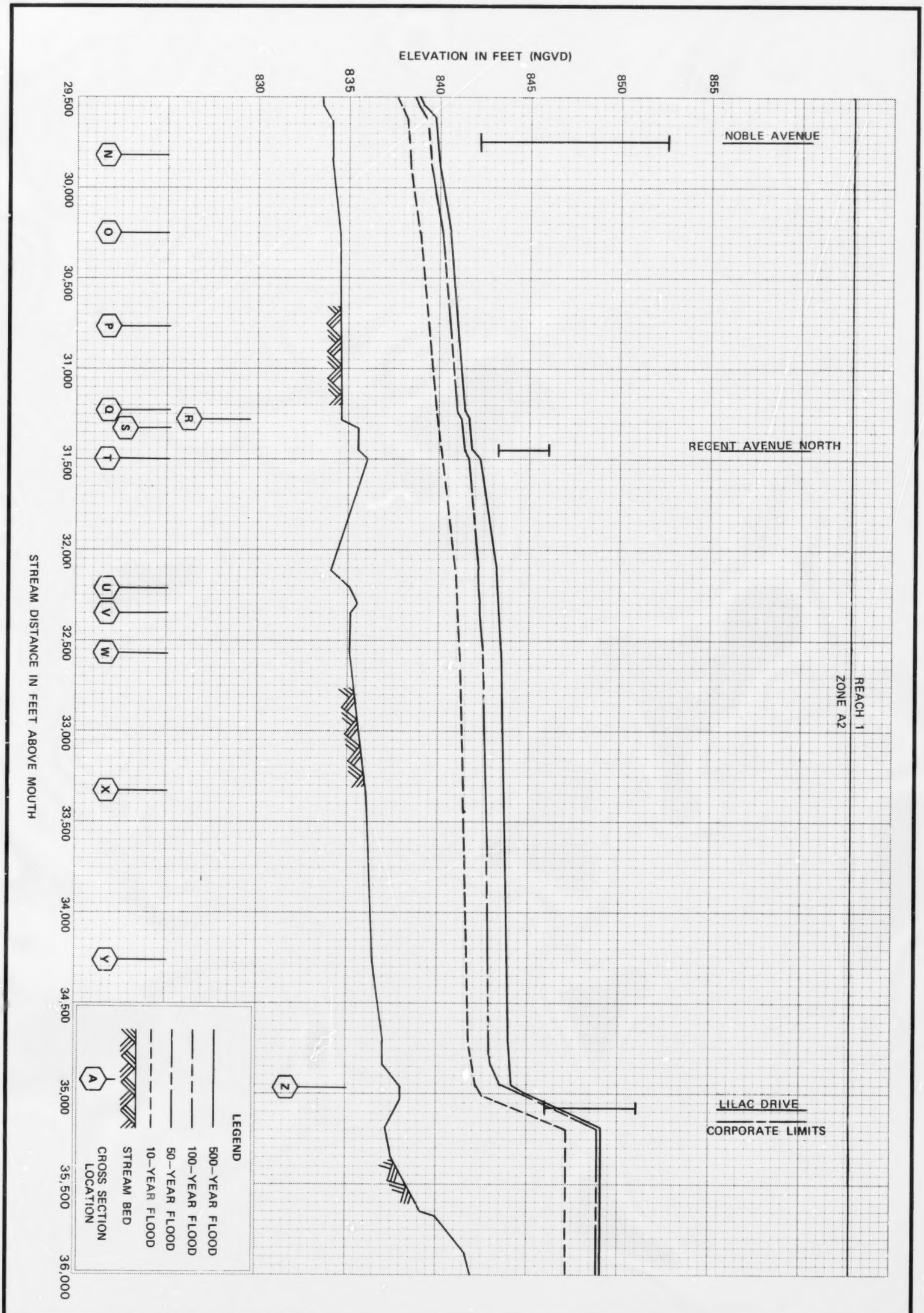

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

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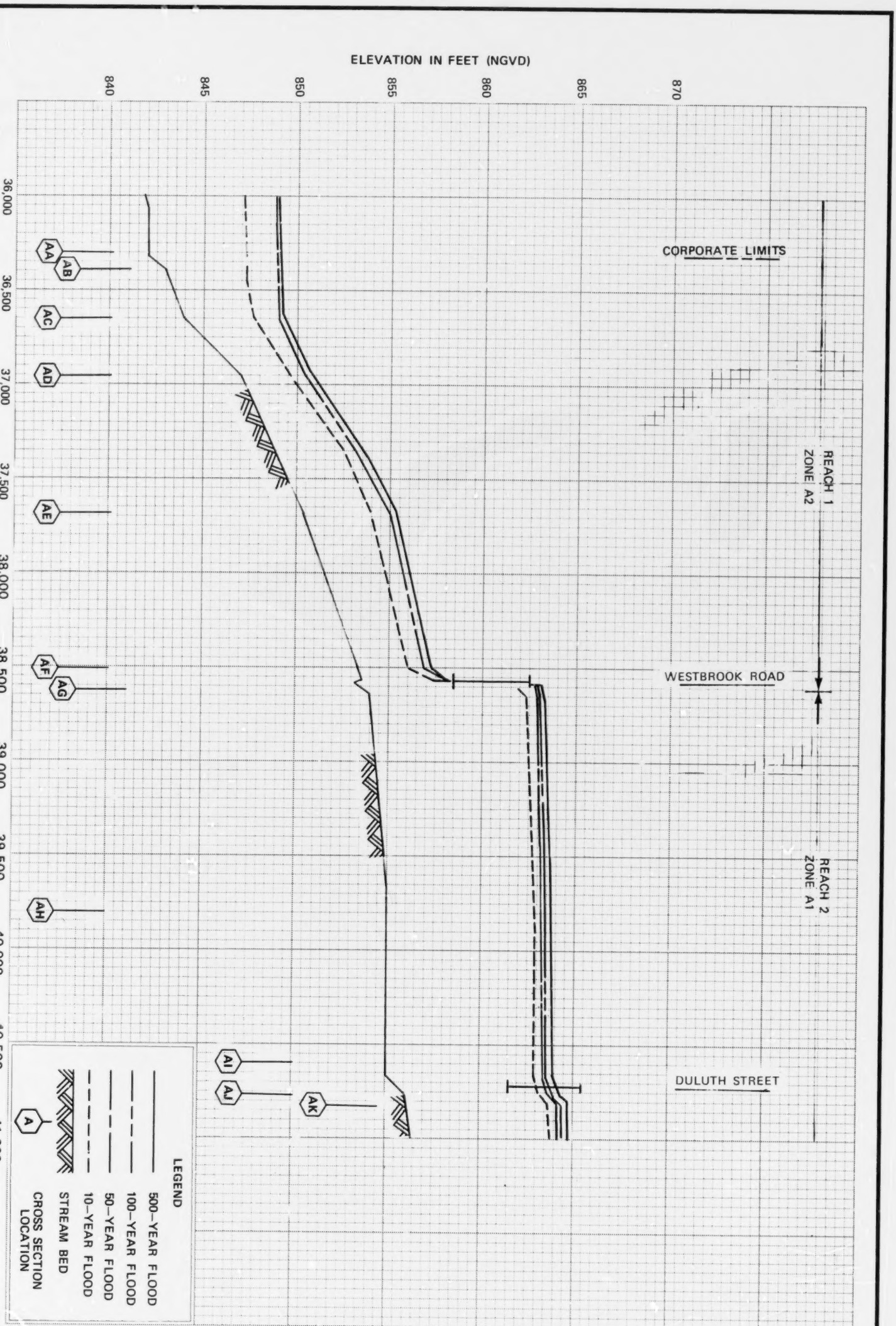

FEDERAL EMERGENCY MANAGEMENT AGENCY

03P

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

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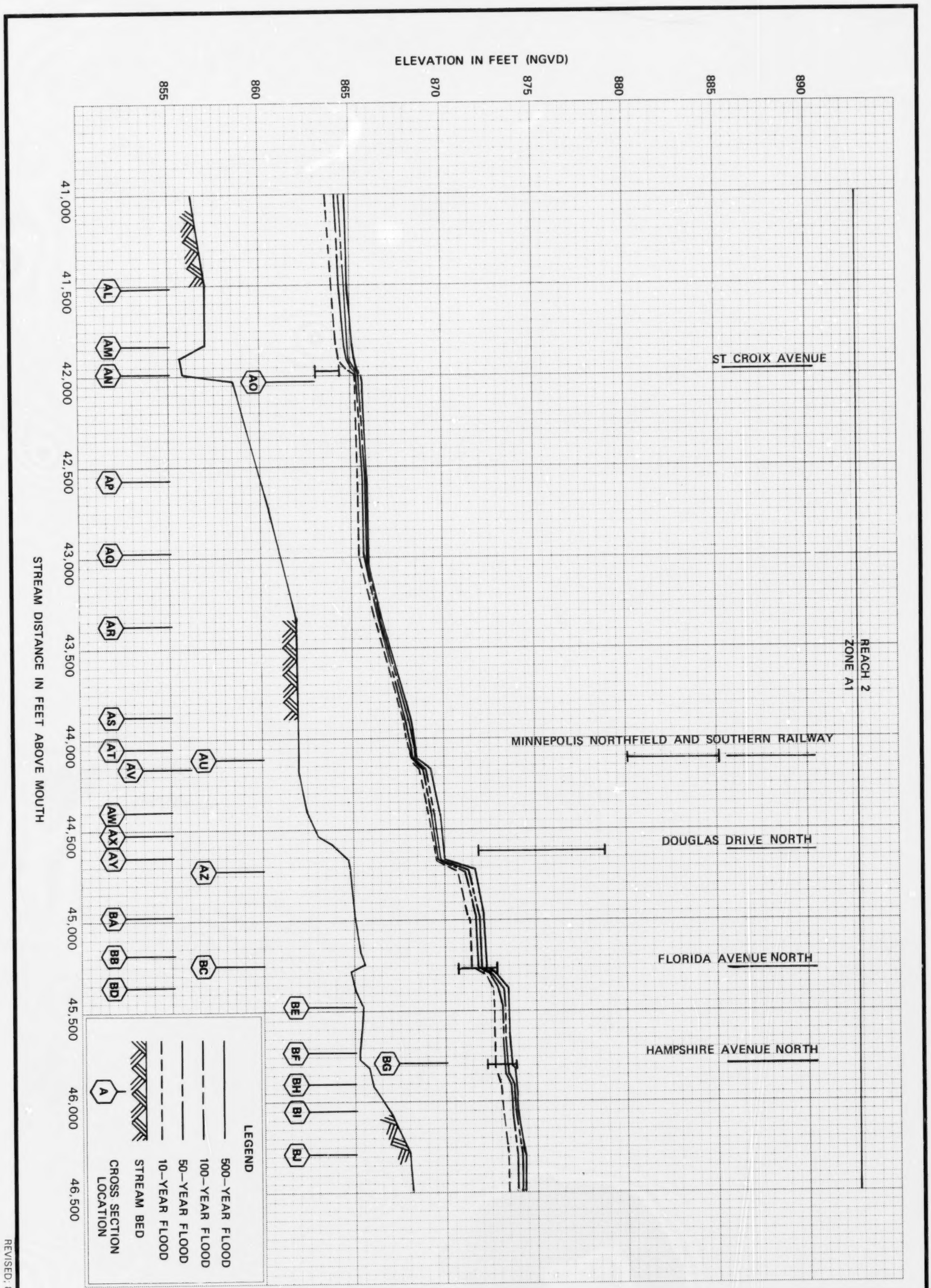

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

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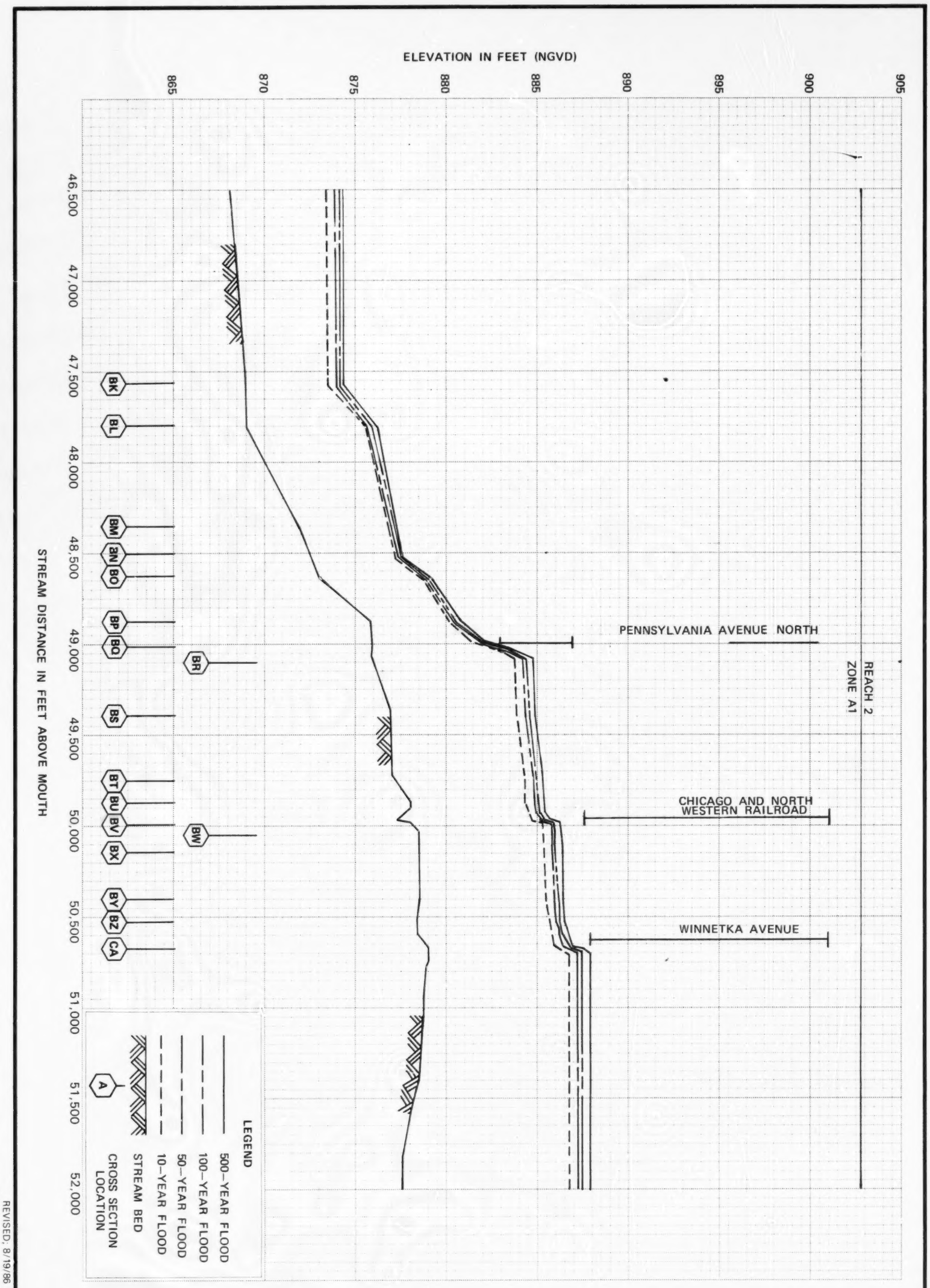

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CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

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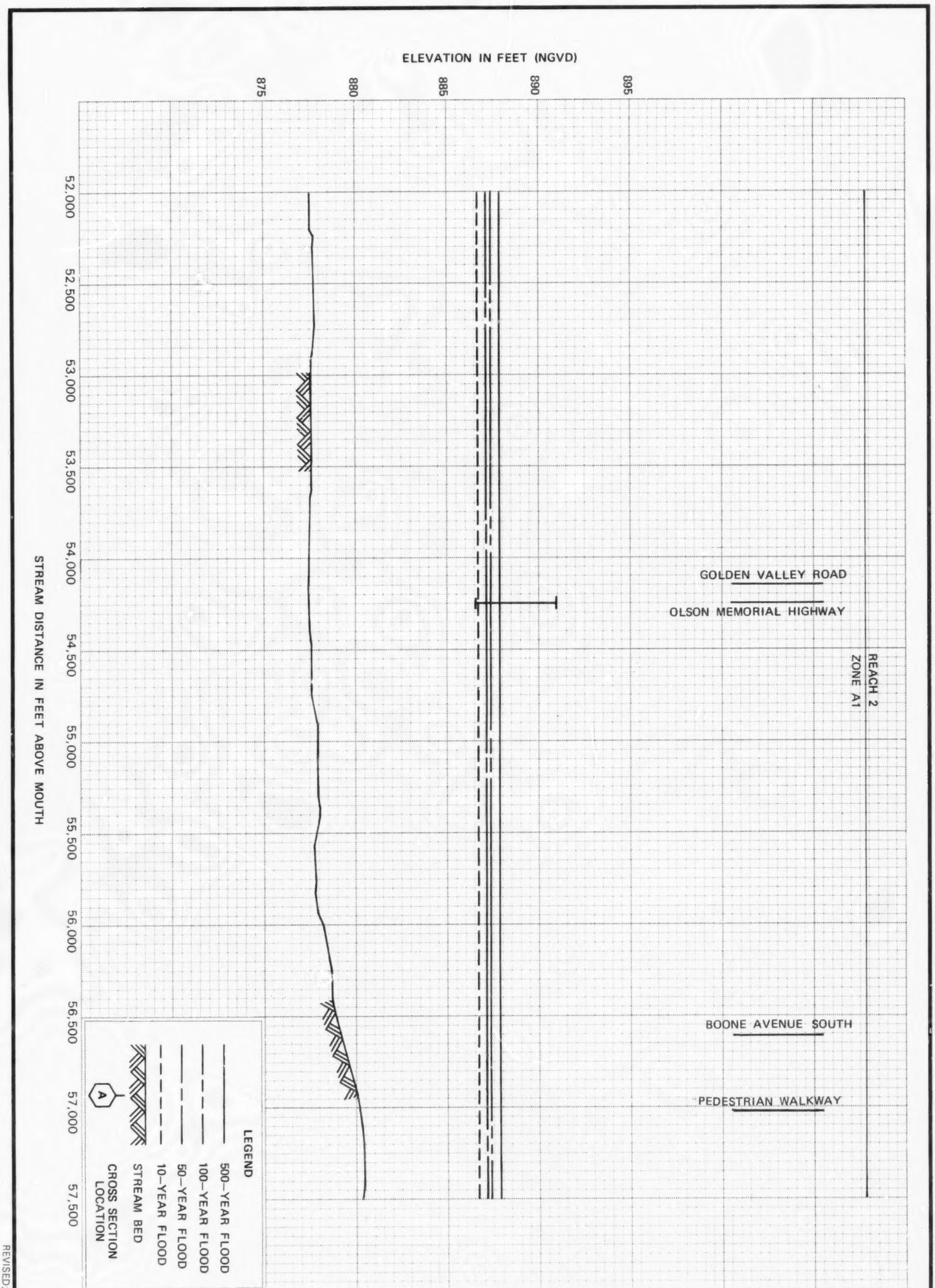

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CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

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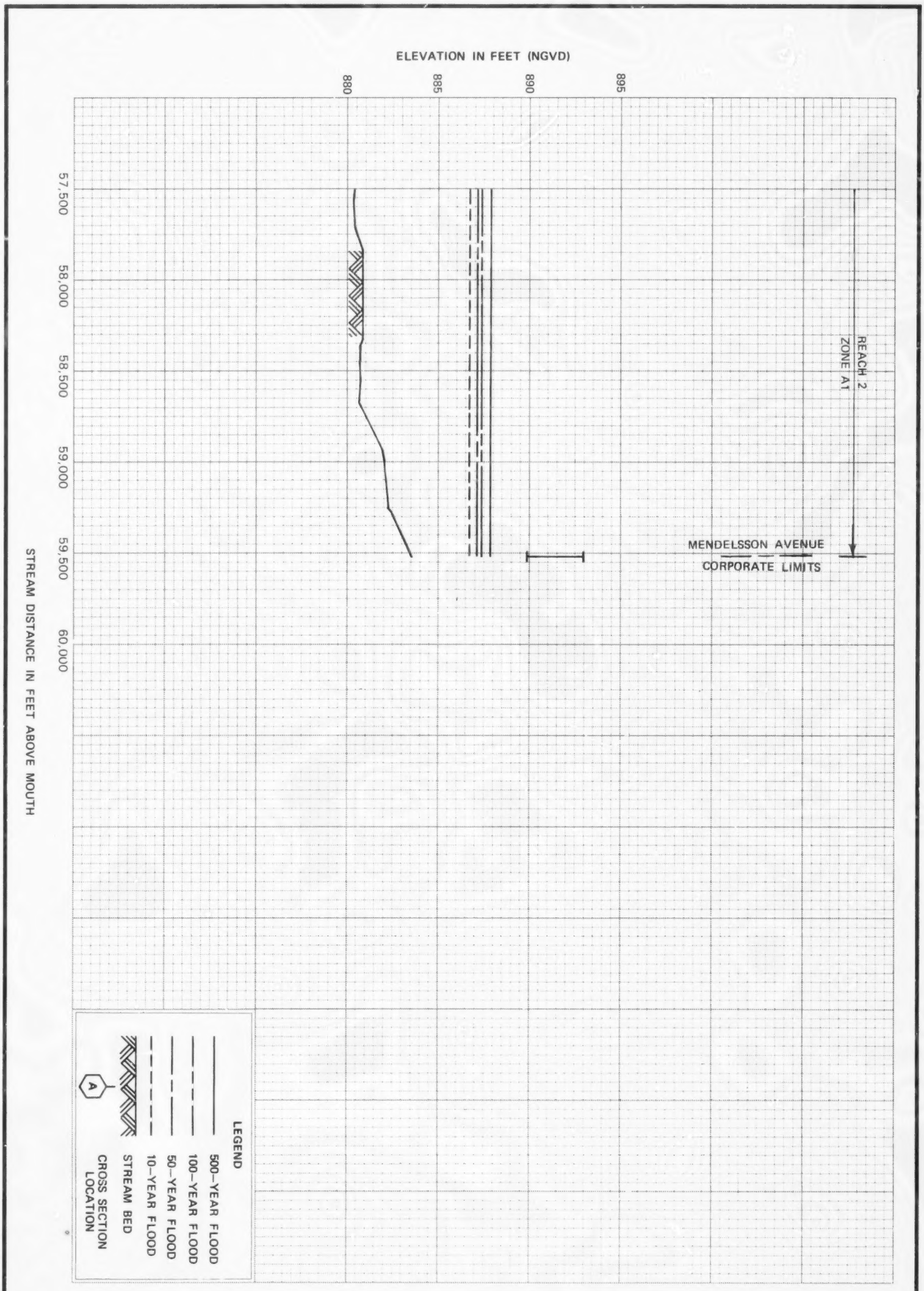

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK

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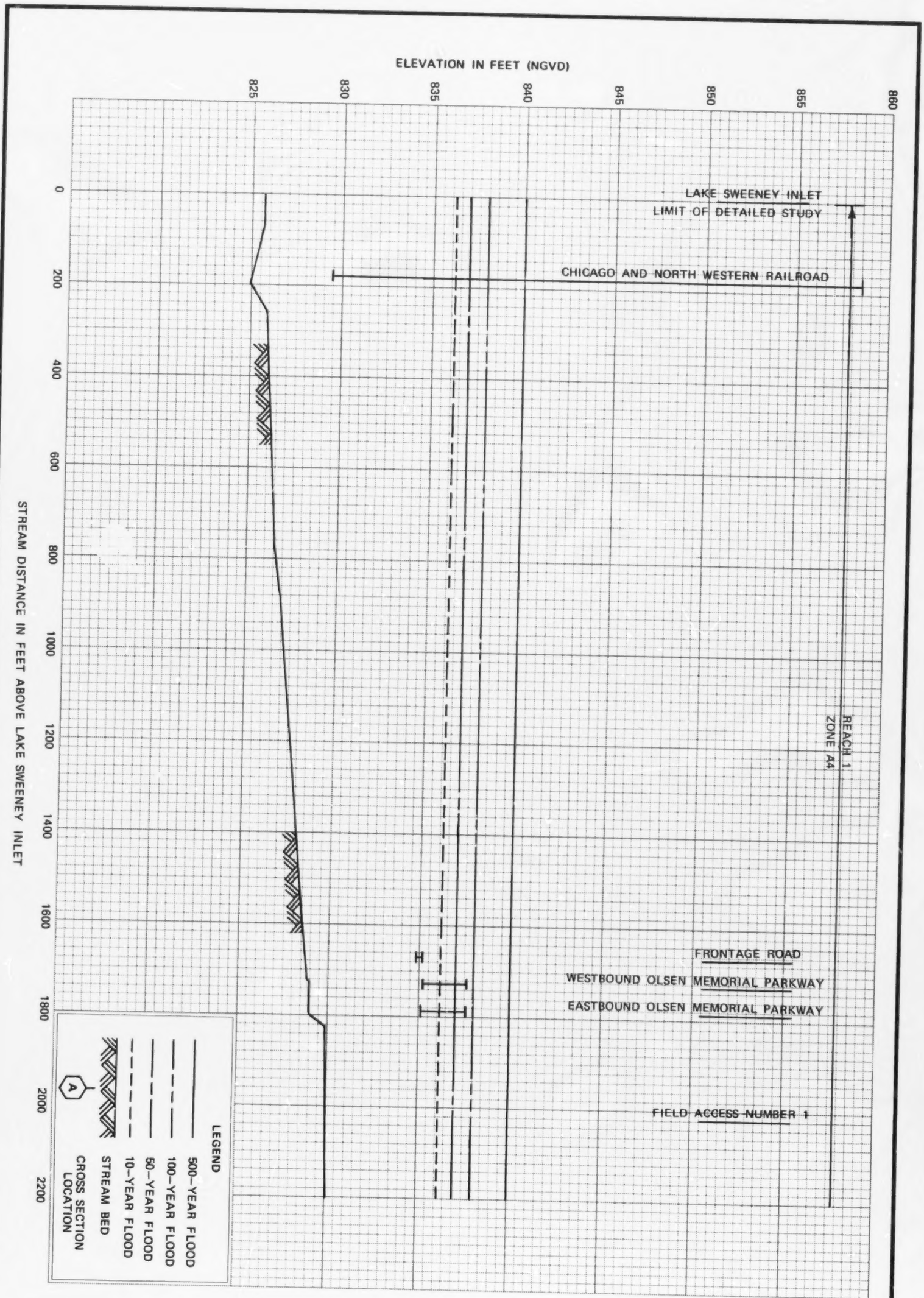

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FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK-SWEENEY LAKE BRANCH

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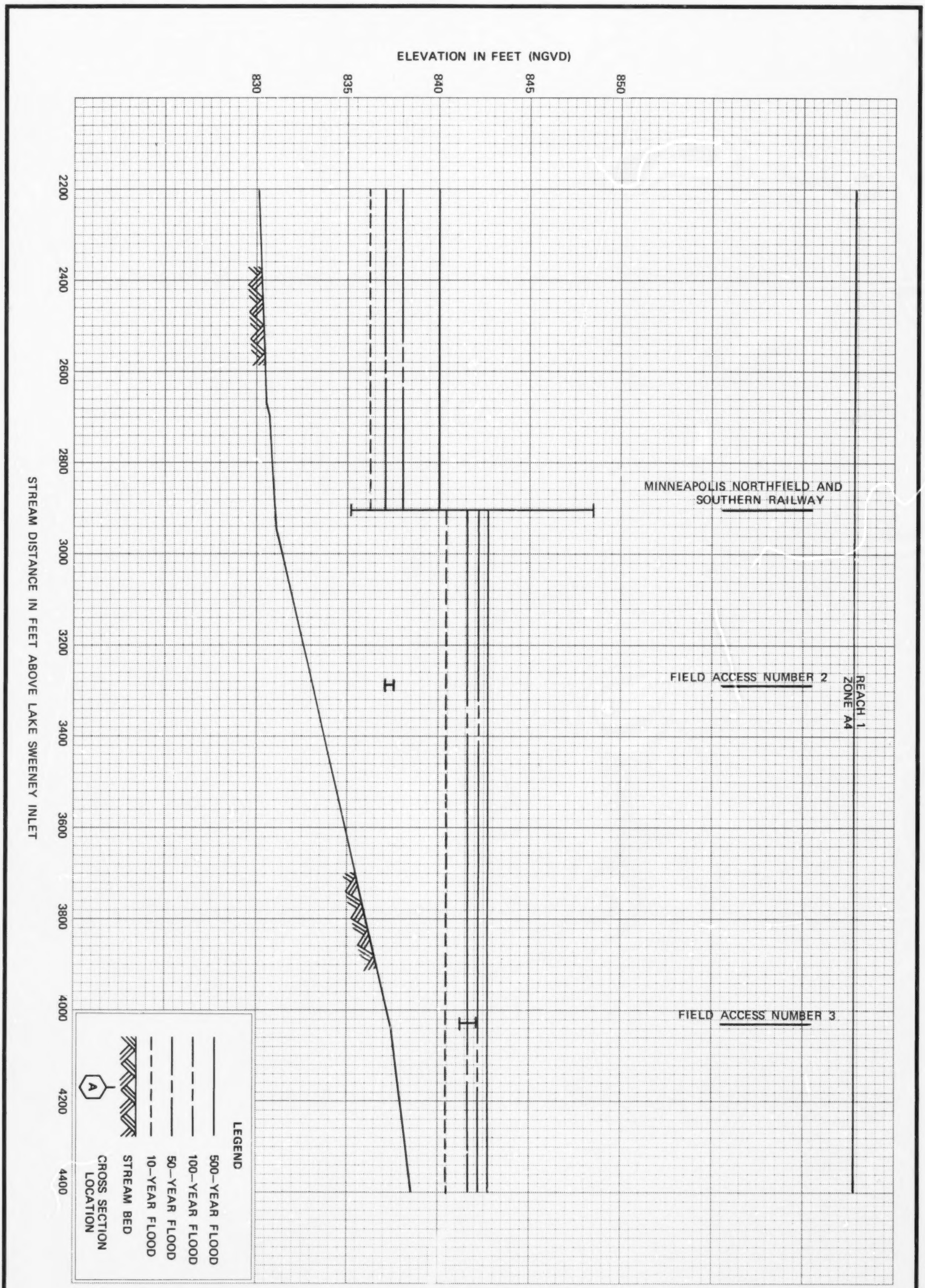

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CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK-SWEENEY LAKE BRANCH

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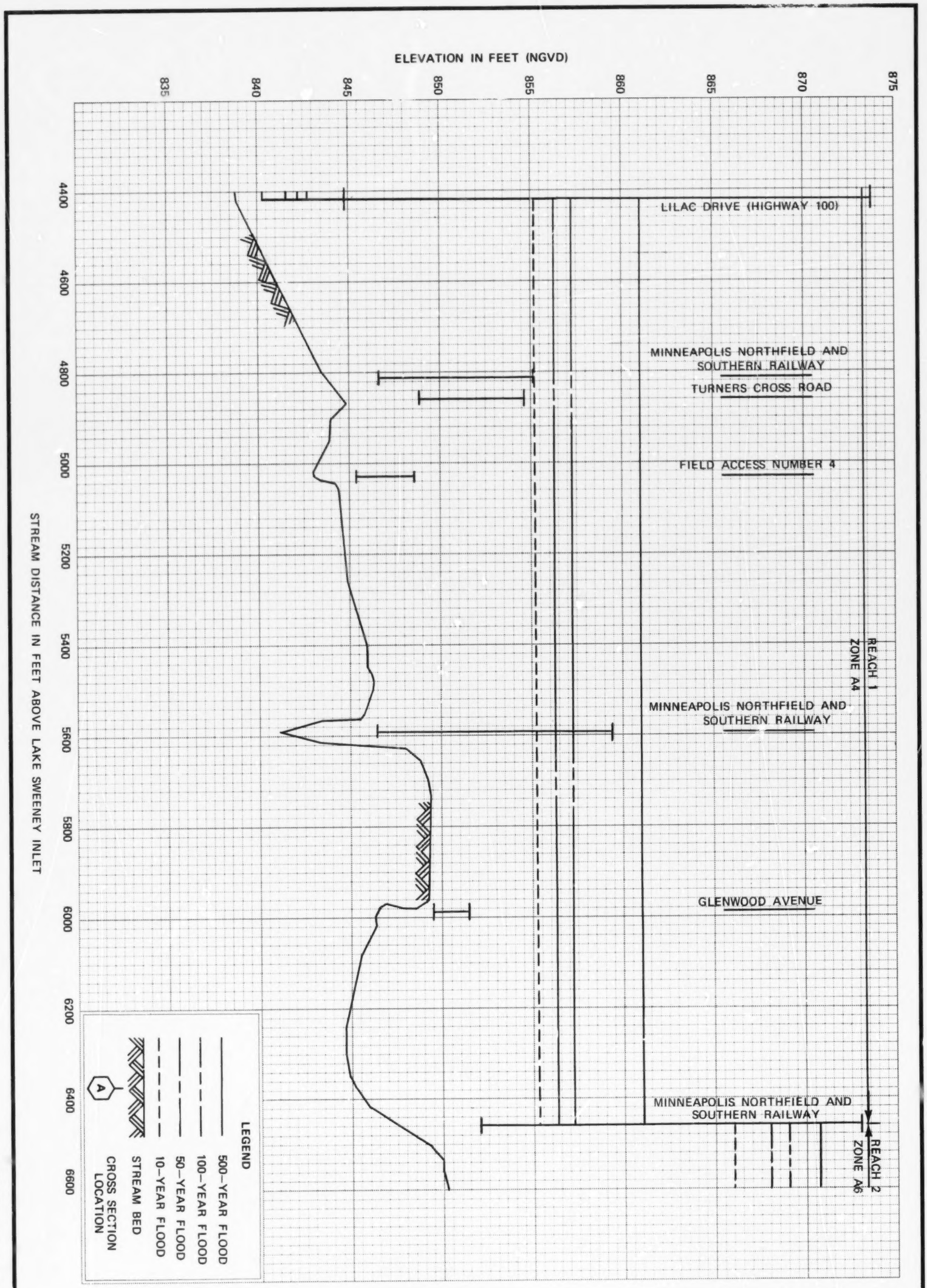

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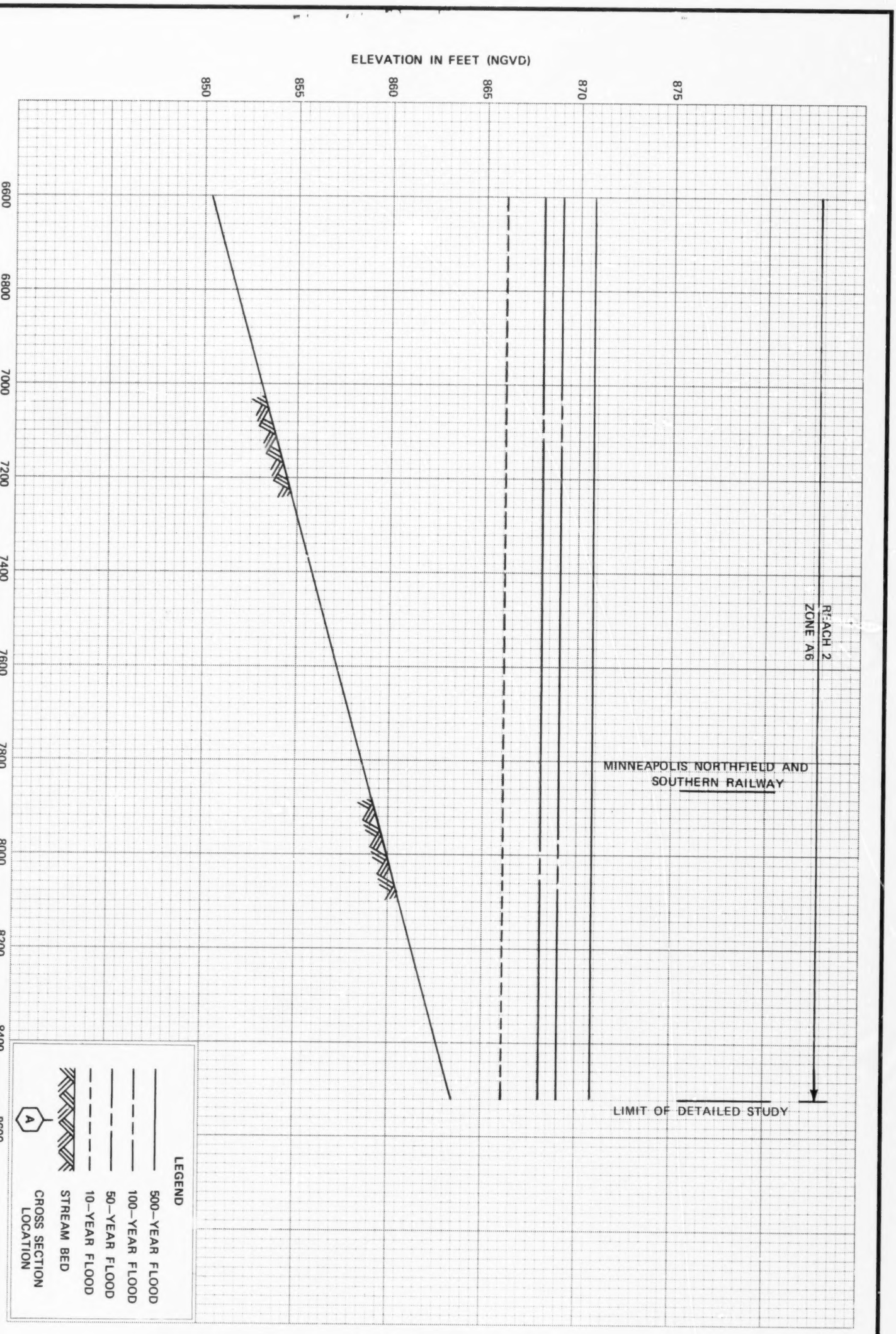
CITY OF GOLDEN VALLEY, MN
(HENNEPIN CO.)

FLOOD PROFILES

BASSETT CREEK-SWEENEY LAKE BRANCH



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